Scope of Work
Interagency Agreement
between
Everglades National Park
and the
U.S. Environmental Protection Agency, Region 4
for the
Everglades Ecosystem Assessment: Everglades Stressor Interactions –
Water Quality, Mercury Contamination, Hydropattern,
Soils, Eutrophication and Habitat

Authority *Section 104 of the Clean Water Act*

Description

Background -- Phases I/II/III: Since 1993, the U.S. Environmental Protection Agency, Region 4 (EPA) has been conducting a landscape-level assessment of the Florida Everglades ecosystem in association with many partners, including Everglades National Park (ENP). The Program uses EPA's Environmental Monitoring and Assessment Program (EMAP) statistical survey design to sample all of the Marl Prairie/Rocky Glades and the Everglades Ridge and Slough physiographic regions, which make up the central Everglades flow-way (Figure 1). The Everglades Ecosystem Assessment [EEA, formerly known as Everglades Regional EMAP (REMAP)] is the only comprehensive monitoring and assessment program that preceded the development of the Comprehensive Everglades Restoration Program (CERP), which subsequently defined several monitoring and assessment objectives documenting status and trends, determining baseline variability, detecting responses to management actions, and improving the understanding of cause and effect relationships. EEA has provided this information system-wide for the entirety of the freshwater Everglades. In Phases I (1993-1996) and II (1999) EPA provided pre-2000 baseline conditions for a broad array of indicators against which future changes can be measured. In Phase III (2005) changes were detected in mosquitofish mercury burdens and soil phosphorus concentrations. Project reports containing implications for CERP managers, as well as all program data, can be found at http://www.epa.gov/region4/sesd/sesdpub_completed.html.

Future EEA Phases: The overarching objective of EEA is to measure the condition of ecological resources in the Marl Prairie/Rocky Glades and the Everglades Ridge and Slough physiographic regions; and to document ecosystem responses as CERP restoration efforts change the quality, quantity, timing and distribution of water, and as State agencies implement control strategies for pollutants such as phosphorus and mercury. EEA employs an integrated, holistic

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approach in a consistent manner at the landscape level -- the only effort to do so throughout the entire freshwater Everglades ecosystem.

EEA has provided data relevant to 23 CERP performance measures for the Everglades Ridge and Slough and the Marl Prairie/Rocky Glades physiographic regions -- seven for the Greater Everglades, one for the Miccosukee Reservation, three for Everglades National Park, one for soil performance, one for animal performance, five for plant performance and five for hydrological performance. Among these 23 are nine water quality measures.

Objectives

The EEA has a five-fold purpose:
1) Contribute to the CERP by monitoring the condition and trends in the Everglades ecosystem;
2) Assess the effects and potential risks due to mercury methylation and bioaccumulation in the ecosystem and interactions with eutrophication, hydropatterns, and habitat alteration;
3) Assess the effects and potential risks from environmental stresses, such as hydropattern modification, habitat alteration, mercury and phosphorus loading, and eutrophication, on the Everglades ecosystem;
4) Apply an improved monitoring design and ecological assessment protocol for evaluating the relative risks of environmental stressors acting on the Everglades ecosystem; and
5) Provide scientifically credible information on a regular basis that contributes to management decisions on Everglades restoration issues.

Future EEA phases would continue change detection and assessments of:
- concentrations of drivers, including nitrogen, phosphorus, carbon, and sulfur, in water and soil over time and space,
- hydropattern modifications in the system and responses during dry and wet seasons,
- soil thickness
- habitat alterations associated with nutrient loading and hydropattern changes,
- methylmercury contamination,
- mechanisms controlling mercury methylation,
- bioaccumulation of methylmercury,
- interacting stressors through structural equation modeling, and
- management implications of these issues.

This monitoring and assessment project has been guided from the outset by the following seven policy-relevant questions which are equally applicable to the four major issues affecting the Everglades ecosystem (hydropattern modification, eutrophication, habitat alteration and mercury contamination). What is the magnitude of the problem? What is the extent of the problem? Is there a trend? What are the associations with the problem? What are the sources of the problem? What is the risk to the ecological resources? What are the solutions?

Design

The probability design used to sample the Everglades marsh in Phases I - III was developed from the EMAP base grid in order to ensure spatial coverage. The design includes stratification by the four major subareas of the system, the Water Conservation Areas [WCA1 (also known as Loxahatchee National Wildlife Refuge – LOX), WCA2, and WCA3, and ENP, to ensure that coverage of smaller subareas is adequate for obtaining variance estimates. A consistent sample size of approximately 125 random points per seasonal survey ensures acceptable confidence intervals around estimated environmental parameters. This design criterion is compatible with logistical considerations allowing helicopter- supported crews to complete all sampling in about 15 days, which also matches throughput capacities of cooperating analytical laboratories. In future phases EPA will utilize an improved design that features a mix of new random points and points from the previous Phase. This approach is the only one that produces quantitative statements with known confidence about environmental condition across the entire population over space and time; for example, that the proportion of the Everglades having a total phosphorus concentration greater than 400 mg/kg (the CERP goal) in soil was 49.3 ± 7.1 % in 2005, and that this proportion is statistically significantly greater than the 33.7 ± 5.4 % measured in 1995-1996.

Deliverables

- All project data will be posted on the internet and available for use to all parties as soon as these data have been through extensive quality assurance/quality control processes.
- A GIS-based data retrieval system will be available through the internet. A prototype of this system was developed for Phase III and is at http://digir.fiu.edu/gmaps/EverMap.php.
- Structural equation models linking stressors, other environmental factors, and responses. Candidate variables include water depth; chemical constituents (e.g., organic carbon, phosphorus, sulfate, sulfide, total mercury, and methyl mercury) in surface water, floc, soil, and biota such as periphyton and mosquitofish; and metrics of habitat alteration. Structural equation modeling (SEM) estimates the strength of associations among different variables simultaneously, by evaluating patterns of covariance among them. SEM is a useful approach for examining complex systems such as the Everglades. Projections based on this modeling will provide estimates of what would be expected under different CERP management scenarios including hydropattern restoration and pollutant loading reductions.
- Synthesis reports with a CERP management focus, similar to the Phase I, II, and III summary status reports. In addition, progress reports will be submitted periodically by each Principal Investigator on the Project Team. These reports will constitute the Investigator's Annual Reports. Findings will also be presented at scientific conferences and published on an on-going basis in the peer-reviewed scientific literature.

Estimated Cost and In-kind Services:

The overall budget for a one-pass survey in the wet season of 2014 is $1.080M. USEPA Region 4 will provide $840K in cash , as well as in-kind services (personnel, vehicles, field and analytical equipment, etc.) which are conservatively estimated as contributing an additional $600K. EPA has already made a significant investment for the Program in terms of capital equipment, analytical instruments, and methods development over the years. The field sampling team has experience doing this work in the Everglades dating back to 1993. Project personnel are already in place; many of the 90+ people involved last time are still available. ENP's share is $240K, broken down in Table 1. ENP's share makes the project possible by funding essential overtime and travel for field crews, as well as equipment and supplies and a portion of contractual expenses.

The overall budget includes all aspects of the project, including field sampling, laboratory analyses, dissemination of project findings, and interpretive reporting for ENP, EPA, and CERP managers and their supporting scientists such as the Technical Oversight Committee and the Task Force Working Group. This budget estimate assumes that participating entities would honor reduced overhead rates previously negotiated with the Federal government.